CLAIMS

1. A magnetic head assembly that has an air bearing surface (ABS) comprising:

a read head including:

a current perpendicular to planes (CPP) sensor having a central portion which defines a track width of the read head and first and second side portions on each side of the central portion;

said central portion of the sensor including:

a ferromagnetic pinned layer that has a magnetic moment;

an antiferromagnetic pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer;

a ferromagnetic free layer structure that has a magnetic moment; and

a nonmagnetic spacer layer located between the free layer structure and the pinned layer;

said first and second side portions of the sensor including:

first and second lateral extensions of the free layer structure respectively; and

first and second electrically nonconductive antiferromagnetic (AFM) layers exchange coupled to the first and second lateral extensions of the free layer structure respectively for longitudinally biasing the first and second lateral extensions of the free layer structure respectively.

2. A magnetic head assembly as claimed in claim 1 wherein each of the first and second AFM layers is composed of nickel oxide (NiO).

3. A magnetic head assembly as claimed in claim 1 further comprising:

a write head including:

ferromagnetic first and second pole piece layers that have a yoke portion located between a pole tip portion and a back gap portion;

a nonmagnetic write gap layer located between the pole tip portions of the first and second pole piece layers;

an insulation stack with at least one coil layer embedded therein located between the yoke portions of the first and second pole piece layers; and

the first and second pole piece layers being connected at their back gap portions;

the read head further including:

a ferromagnetic first shield layer; and

the sensor being located between the first shield layer and the first pole piece layer.

4. A magnetic head assembly as claimed in claim 3 wherein the free layer structure is located between pinned layer and the first pole piece layer.

5. A magnetic head assembly as claimed in claim 4 wherein each of the first and second AFM layers is composed of nickel oxide (NiO).

6. A magnetic head assembly as claimed in claim 3 wherein the pinned layer is located between the free layer structure and the first pole piece layer.

7. A magnetic head assembly as claimed in claim 6 wherein each of the first and second AFM layers is composed of nickel oxide (NiO).

8. A magnetic disk drive including at least one magnetic head assembly wherein the magnetic head assembly has an air bearing surface (ABS) and includes a write head and a read head, comprising:

the write head including:

ferromagnetic first and second pole piece layers that have a yoke portion located between a pole tip portion and a back gap portion;

a nonmagnetic write gap layer located between the pole tip portions of the first and second pole piece layers;

an insulation stack with at least one coil layer embedded therein located between the yoke portions of the first and second pole piece layers; and

the first and second pole piece layers being connected at their back gap portions;

the read head including:

a sensor having a central portion which defines a track width of the read head and first and second side portions on each side of the central portion; and

the sensor being located between the first shield layer and the first pole piece layer;

the central portion of the sensor including:

a ferromagnetic pinned layer that has a magnetic moment;

an antiferromagnetic pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer;

a ferromagnetic free layer structure that has a magnetic moment; and

a nonmagnetic spacer layer located between the free layer structure and the pinned layer;

said first and second side portions of the sensor including:

first and second lateral extensions of the free layer structure respectively; and

first and second electrically nonconductive antiferromagnetic (AFM) layers exchange coupled to the first and second lateral extensions of the free layer structure respectively for longitudinally biasing the first and second lateral extensions of the free layer structure respectively;

a housing;

a magnetic disk rotatably supported in the housing;

a support mounted in the housing for supporting the magnetic head assembly with said ABS facing the magnetic disk so that the magnetic head assembly is in a transducing relationship with the magnetic disk;

a spindle motor for rotating the magnetic disk;

an actuator positioning means connected to the support for moving the magnetic head to multiple positions with respect to said magnetic disk; and

a processor connected to the magnetic head, to the spindle motor and to the actuator for exchanging signals with the magnetic head, for controlling movement of the magnetic disk and for controlling the position of the magnetic head.

9. A magnetic disk drive as claimed in claim 8 wherein the free layer structure is located between pinned layer and the first pole piece layer.

10. A magnetic disk drive as claimed in claim 9 wherein each of the first and second AFM layers is composed of nickel oxide (NiO).

11. A magnetic disk drive as claimed in claim 8 wherein the pinned layer is located between the free layer structure and the first pole piece layer.

12. A magnetic disk drive as claimed in claim 11 wherein each of the first and second AFM layers is composed of nickel oxide (NiO).

13. A method of making a read head that has an air bearing surface (ABS) comprising the steps of:

forming a ferromagnetic first shield layer;

forming an antiferromagnetic pinning layer on the first shield layer;

forming a ferromagnetic pinned layer on and exchange coupled to the pinning layer so that the pinning layer pins a magnetic moment of the pinned layer;

forming a nonmagnetic spacer layer on the pinned layer;

forming a first portion of a free layer on the spacer layer;

forming a nonmagnetic cap layer on the first portion of the free layer;

forming a mask on the cap layer with a width that defines a track width of the read head;

milling away exposed portions of the cap layer, a portion of the free layer, spacer layer and pinned layer and backfilling with an electrically nonconductive antiferromagnetic material to form first and second antiferromagnetic (AFM) layers interfacing first and second side surfaces of remaining portions of the cap layer, a portion of the free layer, spacer layer and pinned layer;

removing the mask;

removing a remaining portion of the cap layer down to a remaining first portion of the free layer;

forming a second portion of a free layer on the remaining first portion of the free layer and on each of the first and second AFM layers; and

forming a ferromagnetic second shield layer on the second portion of the free layer.

14. A method of making a read head as claimed in claim 13 wherein the first and second AFM layers are formed of nickel oxide.

15. A method of making a read head that has an air bearing surface (ABS) comprising the steps of:

forming a ferromagnetic first shield layer;

forming a free layer on the first shield layer;

forming a nonmagnetic spacer layer on the free layer;

forming a ferromagnetic pinned layer on the spacer layer with a magnetic moment;

forming an antiferromagnetic pinning layer on the pinned layer for pinning the magnetic moment of the pinned layer;

forming a nonmagnetic cap layer on the pinning layer;

forming a mask on the cap layer with a width that defines a track width of the read head;

milling away all exposed portions of the cap layer, pinning layer, pinned layer and spacer layer down to the free layer so that first and second side portions of the free layer are exposed beyond the track width and backfilling with an insulating antiferromagnetic material to form first and second insulative antiferromagnetic (AFM) layers which interface and are exchange coupled with said first and second side portions of the free layer respectively; and

forming a ferromagnetic second shield layer on the cap layer and the first and second AFM layers.

16. A method of making a read head as claimed in claim 15 wherein the first and second AFM layers are formed of nickel oxide.

17. A method of making a magnetic head assembly that has an air bearing surface (ABS) comprising the steps of:

making a read head including the steps of:

forming a current perpendicular to planes (CPP) sensor having a central portion which defines a track width of the read head and first and second side portions on each side of the central portion;

a making of said central portion of the sensor including the steps of:

forming a ferromagnetic pinned layer that has a magnetic moment;

forming an antiferromagnetic pinning layer exchange coupled to the pinned layer for pinning the magnetic moment of the pinned layer;

forming a ferromagnetic free layer structure that has a magnetic moment; and

forming a nonmagnetic spacer layer between the free layer structure and the pinned layer;

a making of said first and second side portions of the sensor including the steps of:

forming first and second lateral extensions of the free layer structure in said first and second side portions respectively; and

forming first and second electrically nonconductive antiferromagnetic (AFM) layers exchange coupled to the first and second lateral extensions of the free layer structure respectively for longitudinally biasing the first and second lateral extensions of the free layer structure respectively.

18. A method as claimed in claim 17 wherein each of the first and second AFM layers is formed of nickel oxide (NiO).

19. A method as claimed in claim 18 further comprising the steps of:

making a write head including the steps of:

forming ferromagnetic first and second pole piece layers that have a yoke portion between a pole tip portion and a back gap portion;

forming a nonmagnetic write gap layer between the pole tip portions of the first and second pole piece layers;

forming an insulation stack with at least one coil layer embedded therein between the yoke portions of the first and second pole piece layers; and

connecting the first and second pole piece layers at their back gap portions;

a making of the read head further including the steps of:

forming a ferromagnetic first shield layer; and

forming the sensor between the first shield layer and the first pole piece layer.

20. A method as claimed in claim 19 wherein the free layer structure is formed between pinned layer and the first pole piece layer.

21. A method as claimed in claim 20 wherein the pinned layer is formed between the free layer structure and the first pole piece layer.